

## INTRODUCTION

This Proposed Plan presents a range of alternatives and identifies the Preferred Alternative for cleaning up contaminated soil and groundwater present at the Lockwood Solvent Groundwater Plume Site (LSGPS) in Billings, Montana. This document is issued by the Montana Department of Environmental Quality (DEQ), the technical lead for the LSGPS, in consultation with the United States Environmental Protection Agency (EPA), the enforcement lead for the LSGPS. DEQ, in consultation with EPA, will select a final remedy for the LSGPS, after reviewing and considering all information submitted during the 30-day public comment period following release of this Proposed Plan. DEQ, in consultation with EPA, may modify the Preferred Alternative or select another remedial alternative based on new information or public comments received during the comment period. Therefore, the public is encouraged to review and comment on all of the alternatives presented in this Proposed Plan.

DEQ is issuing this Proposed Plan under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as part of its public participation responsibilities. This Proposed Plan summarizes information found in greater detail in the Administrative Record file for the LSGPS. Please see the last page for Administrative Record locations.

DEQ and EPA encourage the public to review the Administrative Record to gain a more comprehensive understanding of the LSGPS and Superfund activities conducted at the LSGPS.

A “Glossary of Terms” is located at the end of this document to assist the reader in understanding terms used in this Proposed Plan.

### PROPOSED REMEDIAL ACTION PREFERRED ALTERNATIVE

Brenntag Source Area Groundwater: Treat contaminated groundwater in place with a permeable reactive barrier and enhanced bioremediation.

Brenntag Source Area Soil: Excavate and thermally treat shallow contaminated soil in northwest source area; treat shallow contaminated soil in place with soil vapor extraction in tank farm area; treat contaminated soil below the water table in place with chemical oxidation.

Beall Source Area Groundwater: Treat contaminated groundwater in place with enhanced bioremediation.

Beall Source Area Soil: Treat contaminated soil in place with soil vapor extraction.

Site-wide Groundwater: Treat contaminated groundwater in place with enhanced bioremediation and monitored natural attenuation.

Cost: approximately \$14.3 million

### You're invited to review and comment on this Proposed Cleanup Plan!

The **public comment period** runs from **November 15, 2004 to December 14, 2004**. During this time, please send written comments to:

Lockwood Comments  
Catherine LeCours  
Montana Department of Environmental  
Quality  
P.O. Box 200901  
Helena, MT 59620-0901

or electronically to: [clecours@state.mt.us](mailto:clecours@state.mt.us)

You are also encouraged to comment in person for the record at the public meeting: **Thursday**

**December 2, 2004 from 7:00-10:00 pm**

**at Lockwood School Cafeteria  
1932 U.S. Highway 87  
Billings, Montana**

For more information, please call Catherine LeCours, DEQ, 406-841-5040; or toll-free at 1-800-246-8198

SITE BACKGROUND

The LSGPS (see Figure 1) is a 580-acre site on the outskirts of Billings, in Yellowstone County, Montana, consisting of soil and groundwater contaminated with chlorinated solvents. The primary contaminants of concern are the volatile organic compounds tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE) (including both cis- and trans- isomers), and vinyl chloride (VC). On December 1, 2000, the LSGPS was officially placed on EPA’s National Priorities List.

Previous investigations by DEQ, EPA, and others indicate chlorinated solvents at the LSGPS have impacted groundwater, surface water, soil, soil vapor, and indoor air. These investigations identified two source areas where elevated concentrations of contaminants are found in soil and associated groundwater; the Brenntag West Inc. (Brenntag) and Beall Trailers Inc. (Beall) properties.

Brenntag (formerly hci Dyce Chemical) is a chemical re-packaging and distribution company. Under previous owners, the property was developed and operations began in 1972. Historic releases of what are believed to be PCE and possibly TCE, as well as petroleum products and other unidentified organic compounds, characterize the Brenntag source area.

Beall manufactures and repairs tanker truck trailers, primarily to transport asphalt. From 1978 to 1990, trailers were cleaned with a solution of dissolved TCE and steam prior to maintenance and/or repair. The wastewater from the steam clean bay was discharged to a septic system and drain field.

PREVIOUS INVESTIGATIONS/REMOVAL ACTIONS

In October 1986, Lockwood Water and Sewer District personnel discovered the presence of benzene and chlorinated solvents in their water supply wells. That discovery led to the initiation of a number of investigations by DEQ of

underground storage tanks and a petroleum pipeline in the vicinity of the Lockwood Water and Sewer District property. In June 1998, DEQ Site Response Section performed an Integrated Assessment of the LSGPS.

During the summer of 2000, EPA’s Emergency Removal Program extended the public water supply line to the Lomond Lane area and 14 residences with contaminated wells were connected by August 2000. EPA also conducted indoor air sampling, provided mitigation for indoor air contamination, and continued the groundwater monitoring. DEQ continued indoor air sampling on a quarterly basis through February 2002.

DEQ began the Remedial Investigation in 2002. The Remedial Investigation included surface and subsurface soil sampling, monitoring well construction and groundwater sampling, aquifer testing, and surface water and sediment sampling. Groundwater sampling continues today. DEQ released the Final Remedial Investigation Report in June 2003 and completed the Feasibility Study in July 2004. In October 2004, EPA’s Superfund Technical Support Program evaluated the groundwater and indoor air sampling results collected since the completion of the Remedial Investigation and Feasibility Study Reports.

ENFORCEMENT ACTIVITIES

On December 16, 1999, EPA issued the first Request for Information letters to Beall and hci Dyce Chemical pursuant to Section 104(e)(2) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). EPA then issued follow-up Request for Information letters to Beall and hci Dyce Chemical on May 25, 2000. The information requests include questions regarding ownership history, locations of historical and current facilities, retention basins, chemical storage areas, all operations involving hazardous chemicals, waste generation and disposal practices, trade name and quantities of chemical products used, and all leaks, spills or releases.

AGENCY CONTACTS

Montana DEQ Contact

Catherine LeCours  
P.O. Box 200901  
Helena, Montana 59620-0901  
406-841-5040  
or toll-free at 1-800-246-8198

U.S. EPA Contact

Bob Fox  
10 West 15<sup>th</sup> Street, Suite 3200  
Helena, Montana 59626  
406-457-4000  
or toll-free at 1-800-457-2690

ADMINISTRATIVE RECORD LOCATIONS

Information Repositories:

The Proposed Plan and other documents in the Administrative Record are available at the following locations:

Administrative Record

Montana DEQ  
1100 N. Last Chance Gulch  
Helena, Montana

Montana State University – Billings Library

1500 North 30<sup>th</sup> Street  
Billings, Montana

You can also view the Proposed Plan on line at:  
<http://www.epa.gov/region8/sf/sites/mt/lockwood.html>

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FRI, DEC 3 & FRI DEC 10 - 7:30 AM-10:00 PM

SAT, DEC 4 & SAT, DEC 11 - 9:00 AM-10:00 PM

Individuals with a disability who need to request reasonable accommodation to attend the Proposed Plan meeting or to receive this information in an alternate accessible format should contact Catherine LeCours with their requests through any method listed above no later than November 30, 2004.

also would meet the statutory preference for the selection of a remedy that involves treatment as a principle element. The Preferred Alternative can change in response to public comment or new information.

COMMUNITY PARTICIPATION

DEQ and EPA provide information regarding the remediation of the LSPGS to the public through

public meetings, the Administrative Record file at MSU-Billings, and announcements published in the *Billings Gazette*. DEQ and EPA encourage the public to gain a more comprehensive understanding of the LSGPS and the Superfund activities conducted at the LSGPS by reviewing the Administrative Record and attending the public meetings.

GLOSSARY OF TERMS	
Administrative Record	The files containing all documents DEQ and EPA used in selecting the remedy at a Superfund site.
Alternative	An option for reducing site risks or addressing site contamination.
Applicable or Relevant and Appropriate Requirements (ARARs)	The federal and state legal requirements and criteria that a selected remedy must attain or comply with. ARARs are identified by chemical-specific (e.g., drinking water standards), location-specific (e.g., floodplain), or action-specific (e.g., air emission standards).
Capital Costs	Expenses related to the design and construction of a remedy, such as labor, equipment, and materials.
Chlorinated Solvents	The primary contaminants of concern including tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC).
Feasibility Study	The portion of a Superfund investigation in which alternatives for addressing site contamination are identified, screened, and evaluated in accordance with EPA guidance and criteria.
National Contingency Plan (NCP)	The EPA regulations governing all cleanups under the Superfund program.
National Priorities List	EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term cleanup.
Operation and Maintenance (O&M) Costs	Costs for ongoing operation of the remedy, including labor, materials, and supplies costs for operating and maintaining equipment, obtaining power, environmental sampling, disposing of sludges, etc.
Present Worth	The current value of all capital and O&M costs over a 30-year project period, calculated at a specified interest rate of 7 percent, per EPA Guidance.
Presumptive Remedies	Cleanup technologies based on historical remedy selection and scientific and engineering evaluations of how well these have performed in the past. EPA expects presumptive remedies to be considered at all applicable sites.
Proposed Plan	The document that describes the agencies' preferred alternatives and requests public input on the proposed remedy.
Record of Decision	The document in which the agencies formally select the remedy for a Superfund site. It includes a summary of site information and the alternatives evaluation process, an identification of final cleanup requirements, and a response to public comments received on the proposed plan.
Remedial Investigation	The portion of a Superfund investigation that identifies and evaluates the nature and extent of contamination at a Superfund site.

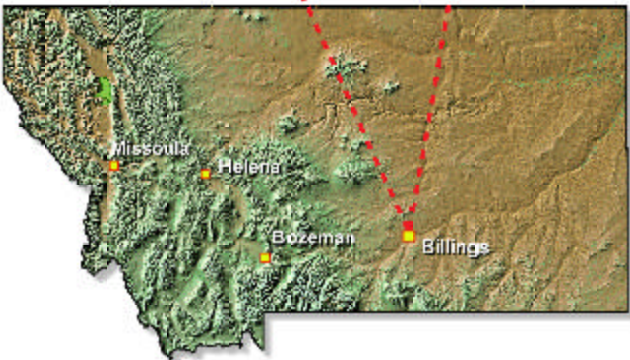
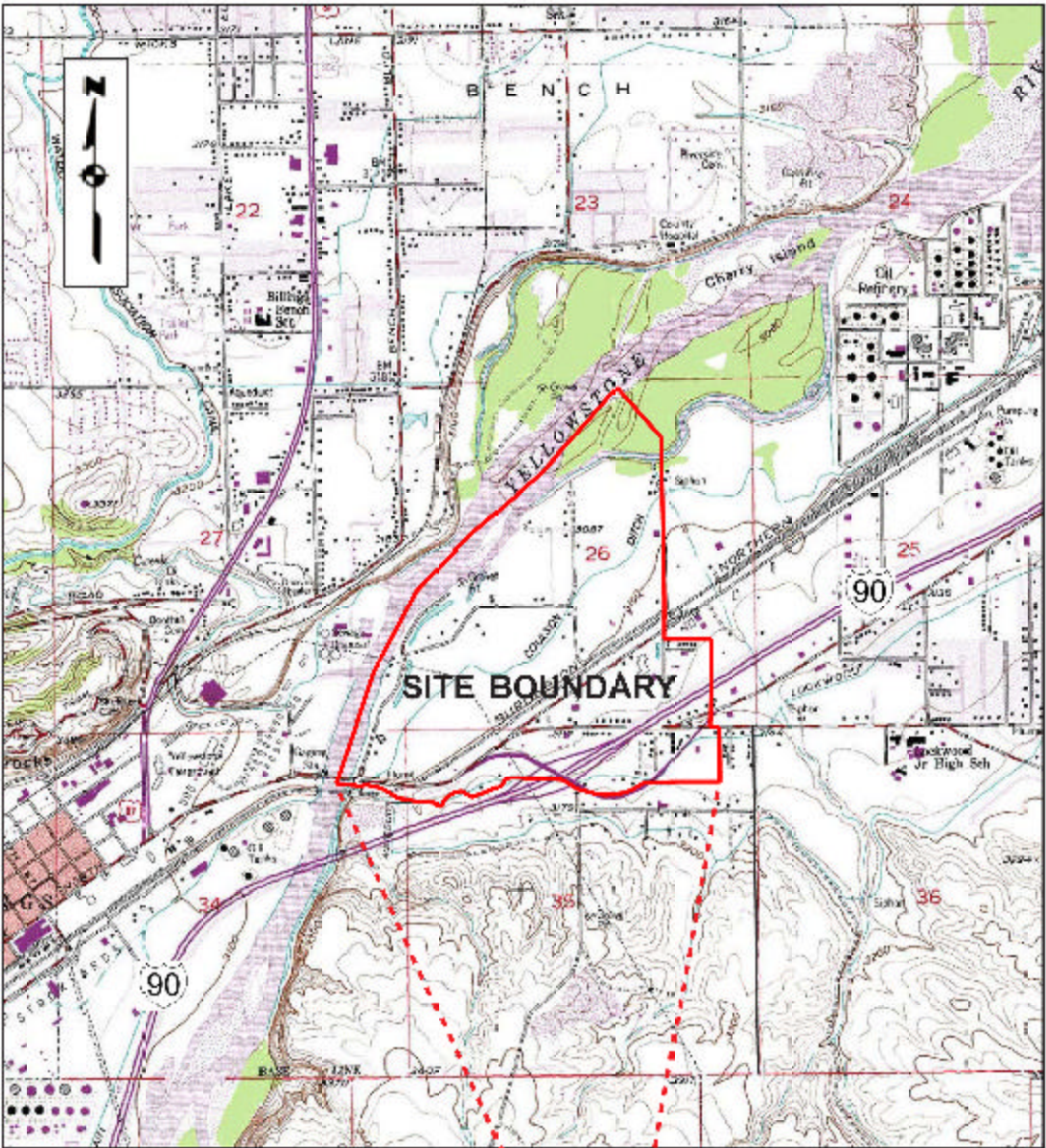


FIGURE 1 - SITE LOCATION

On August 23, 2000, EPA issued letters of General Notice of Potential Superfund Liability to Beall and hci Dyce Chemical. General notice letters notify the recipients of their potential liability under Section 107(a) of CERCLA. Liability includes responsibility for all costs incurred by the government in responding to any release or threatened release at the LSGPS as well as natural resource damages.

**PUBLIC PARTICIPATION**

DEQ has maintained a consistently high level of community involvement at the LSGPS.

Beginning in June 1998, DEQ asked residents to allow samples of water to be taken from private, residential, commercial, and industrial wells. During each sampling event, DEQ has coordinated with residents, business owners, and local government to install monitoring wells and/or collect necessary samples for the investigation. For every sample collected to date, DEQ has notified the property owners in advance and provided them the opportunity to be present during the sampling and collect split-samples. DEQ has mailed the results of the samples to the property owners in a timely manner.

On September 18, 1998, DEQ issued a news release advising residents of Lomond Lane and Doon Avenue their well water contained high levels of chlorinated solvents, including one solvent known to cause cancer and several probable human carcinogens. DEQ provided detailed information of the contamination through telephone calls, letters, and newspaper advertisements. DEQ advised affected residents they should not use well water for drinking, cooking, and bathing. DEQ began providing bottled water to well owners until a permanent source of potable water could be provided.

DEQ and EPA held a public meeting on May 12, 1999, at the Lockwood School to report on recent investigations into groundwater contamination. The meeting included an opportunity to ask questions of representatives from DEQ, EPA, and the Agency for Toxic Substances and Disease Registry (ATSDR).

In May 1999, DEQ distributed a fact sheet including brief descriptions of state and federal programs available to address sites like the LSGPS, a summary of previous investigations at the LSGPS, descriptions of contaminants found, results of the health consultations with the ATSDR, and the outline of reports available for public review at the DEQ office in Billings or at the LSGPS information repository at the Parmly Billings Library in Billings. (Note: The Parmly Billings Library was the information repository at the time the fact sheet was published. Since August 2001, the information repository has been located at the Montana State University-Billings Library.)

In December 1999, EPA discussed its removal program activities at a public meeting in Lockwood. Additional information was provided through distribution of a fact sheet and during a meeting with Yellowstone County commissioners and U.S. Senator Conrad Burns.

On March 24, 2000, DEQ responded to the Montana Environmental Quality Council request for a presentation on the status of the LSGPS. The Environmental Quality Council is a bipartisan, legislative committee serving in an advisory capacity to state natural resource programs. It consists of 17 members, 12 of whom are legislators; four are members of the public; and one non-voting member representing the governor.

DEQ personnel interviewed home and business owners in Lockwood from January 16 to 18, 2001. DEQ then prepared a Community Involvement Plan in October 2001; which identifies issues of concern to the local community regarding the LSGPS.

Staff members from ATSDR conducted interviews and an availability session in Lockwood on January 18, 2001, to provide a foundation for a Public Health Assessment and to guide ATSDR in planning their future activities at the LSGPS.

On May 30, 2001, DEQ and EPA held a public meeting in the Billings office of U.S. Senator Conrad Burns, to discuss concerns of Lockwood

**MODIFYING CRITERIA**

State/Support Agency Acceptance

EPA has consulted with DEQ in the development of this Proposed Plan and concurs with the Plan.

Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends and will be described in the Record of Decision for the LSGPS.

**SUMMARY OF THE PREFERRED ALTERNATIVE**

**Preferred Alternative** – Excavation and Thermal Treatment of Vadose Soil at the Brenntag northwest source area, treatment of vadose soil with Soil Vapor Extraction at the Brenntag tank farm source area and Beall source area, treatment of saturated zone soil with In-Situ Chemical Oxidation at the Brenntag source area, containment and treatment of groundwater with a Permeable Reactive Barrier at the Brenntag source area, treatment of groundwater with Enhanced Bioremediation downgradient of source areas, and Monitored Natural Attenuation of groundwater.

Estimated Capital Cost: \$5,896,539  
Estimated First Year Annual O&M Cost: \$1,040,880  
Estimated Periodic Cost: \$1,219,740  
Permeable Reactive Barrier Replacement Cost (Year 15): \$1,628,764  
Estimated Present Worth Cost: \$14,347,900  
Estimated time to construct and implement: One Year  
Estimated time until RAOs are met:  
Beall source area soil – Five years  
Brenntag source area soil – One year for excavated soil, 10 years for unexcavated soil  
Groundwater and Surface Water downgradient of Brenntag and Beall source areas – Nine years  
Groundwater in Beall and Brenntag source areas – Long term

The Preferred Alternative for remediation at the LSGPS is a combination of technologies to cleanup the source areas, prevent migration of contaminated groundwater from the source areas, and accelerate cleanup of the contaminated groundwater that has already migrated downgradient of the source areas. The Preferred Alternative is Alternative 6 as described above and in the Feasibility Study, with a minor modification in the technologies selected to clean up the Brenntag source area. The contaminated unsaturated soil in the source areas is remediated with a combination of technologies: excavation and thermal treatment in the northwest source area at Brenntag and soil vapor extraction in the tank farm area of Brenntag and at Beall. The contaminated saturated soil in the source areas is remediated with in-situ chemical oxidation using permanganate at Brenntag and enhanced bioremediation with a Hydrogen Release Compound at Beall. Migration of contaminated groundwater from the source areas is prevented through containment and treatment with a permeable reactive barrier at Brenntag and enhanced bioremediation at Beall. Remediation of contaminated groundwater that has already migrated to areas downgradient of the source areas and is present site-wide will be accomplished by enhanced bioremediation followed by monitored natural attenuation.

The Preferred Alternative was selected over the other alternatives because it is expected to meet all RAOs and ARARs within the shortest amount of time for the lowest cost. The treatment options permanently destroy contaminants to achieve risk reduction to concentrations below proposed remediation goals in all environmental media.

Based on the information available at this time, the State of Montana and EPA believe the Preferred Alternative would be protective of human health and the environment, comply with ARARs, be cost-effective, and utilize permanent solutions, presumptive remedies, and alternative treatment technologies to the maximum extent practicable. Because it would treat both the source materials and the groundwater constituting the principle threats, the remedy

environment occur under Alternatives 3, 5, 6, 7, and 8. No off-site water discharges occur under any of the alternatives.

RAOs will not be met in the long term for either groundwater or soil under Alternative 2. RAOs for soil in the two source areas will be met in one year under Alternatives 3 and 8 and in five years under Alternatives 6 and 7. Beall source area soil will meet RAOs in 5 years under Alternative 5. Alternatives 4 and 5 do not meet RAOs for Brenntag source area soil and Alternative 4 does not meet RAOs for Beall source area soil.

RAOs will not be met in the long term for either source area groundwater plumes under Alternatives 2 through 5. RAOs will be met in source area groundwater in the long term under Alternatives 6, 7, and 8. Site-wide groundwater will not meet RAOs in the long term under Alternatives 2 and 3 and is expected to meet RAOs in nine years under Alternatives 4, 6, and 8. Groundwater downgradient of Beall is expected to meet RAOs in twenty-four years and downgradient of Brenntag in 10 years under Alternatives 5 and 7.

Implementability

Alternative 2 is easy to construct and operate as it only involves risk mitigation measures and long-term monitoring.

Soil excavation and soil vapor extraction construction under Alternatives 3, 6, and 8 are moderately difficult in areas where operating facilities exist and may require special techniques or facility relocation. Thermal treatment and soil vapor extraction systems are considered easy to operate, although air discharge limits will need to be met. In-situ chemical oxidation is considered easy to construct and operate under Alternatives 6, 7, and 8.

Permeable reactive barriers are moderately difficult to construct at the Brenntag source area under Alternatives 6, 7, and 8 and difficult to construct in the Beall source area under Alternatives 7 and 8. However, permeable

reactive barriers have been successfully installed at other similar sites and expected construction difficulties are not considered insurmountable. Permeable reactive barriers are expected to be easy to operate. Air sparge/soil vapor extraction groundwater treatment components under Alternatives 4, 7, and 8 and in-situ enhanced bioremediation components under Alternatives 4, 6, and 8 are considered easy to construct and operate.

Thermal treatment of excavated soil is considered the most reliable soil treatment option compared to either soil vapor extraction or in-situ chemical oxidation. Soil vapor extraction and in-situ chemical oxidation are both limited by the heterogeneous subsurface environment and presence of low-permeability, fine-grain silt and clay. Permeable reactive barrier treatment, air sparge/soil vapor extraction, and in-situ bioremediation are all considered moderately reliable technologies. Site-specific pilot or design studies are considered necessary for each in order to maximize effectiveness.

Services, equipment, and materials are considered available for all alternatives and all alternatives are considered administratively feasible.

Finally, Alternatives 2 through 8 require routine monitoring and sampling including 5-year CERCLA reviews. Alternatives 4 through 8 require periodic operations and maintenance, including system monitoring and sampling, replacing parts and pumps periodically, cleaning components, and replacing the granular activated carbon, which will continue for the life of the treatment.

Cost

Alternative 8 is the most expensive alternative followed in descending order by Alternatives 7, 6, 5, 4, 3, and 2.

residents regarding real estate transactions. Participants in the meeting included Lockwood residents, Dwight MacKay, Montana director for Senator Burns, John Wardell, director of the Montana Office of EPA, and representatives of DEQ and the Montana Department of Revenue.

In July 2001, DEQ, EPA, and ATSDR issued a joint handout titled Safe Summer Water Uses. The publication addressed concerns regarding outdoor summer uses of contaminated groundwater from wells. Based on the results of the detailed Risk Assessment performed for the LSGPS, an updated Safe Summer Water Uses fact sheet was distributed in June 2003.

DEQ held two public meetings announcing the release of the Final Remedial Investigation Report in June 2003. The public meetings provided citizens a summary of the findings of the Remedial Investigation, the conclusions of the Risk Assessment, and an opportunity for their questions to be answered. DEQ also presented a tentative schedule for future activities, including the Feasibility Study, Proposed Plan, and Record of Decision.

**SITE CHARACTERISTICS**

The climate at Billings, Montana (including the LSGPS) is classified as semiarid. About one-third of the annual precipitation falls during May and June, with June being the wettest month.

The Brenntag and Beall source areas are located in different portions of the LSGPS and have slightly different geologic and hydrogeologic characteristics.

Groundwater immediately upgradient of the Beall source area enters the alluvial aquifer at the contact with the bedrock aquifer (alluvial aquifer boundary) and flows downgradient toward the Yellowstone River.

The Beall source area is located on an upper terrace of the Yellowstone River floodplain. Alluvial (subsurface) deposits at the Beall source area consist primarily of fine-graded

sands and silts underlain by a thinner sequence of sand and gravels. These deposits overlie the Eagle sandstone bedrock. Bedrock is exposed southwest of the Beall source area at the interchange of Interstate Highway 90 and U.S. Highway 87 East.

Vadose (unsaturated) zone thickness is about 47 feet immediately upgradient of the Beall property, 46 to 49 feet west of the steam clean bay, 43 feet at the west edge of the Beall property, and decreases to 35 feet northwest of the Beall property. Moderate- to low-permeability silts and silty clay were identified in the vadose zone throughout the Beall source area and layers of discontinuous sands were observed in some borings. An alluvial aquifer water-level map prepared from July 2003, data indicate a general north and west flow of groundwater from the Beall source area toward the Yellowstone River. The groundwater flow gradient at the Beall source area is approximately one foot of vertical drop for every 1000 feet of horizontal travel.

Alluvial deposits at the Brenntag source area consist primarily of a sequence of mixed silt, clay, and silty sands underlain by deposits of sand and gravel. These alluvial deposits overlay gray sandstone bedrock (Eagle sandstone).

Vadose zone thickness at the upper (southeastern) portion of the Brenntag property is approximately 15 feet, decreasing to approximately 10 feet at the main tank farm, and decreasing to approximately 7 feet northwest of the property. Moderate- to low-permeability silty clays and silty sand units were identified in the vadose zone throughout the area and thin discontinuous gravels were observed in some borings. An alluvial aquifer water-level map prepared from July 2003, data indicate a general northwest flow of groundwater at the Brenntag source area. The groundwater flow gradient is approximately seven feet of vertical drop per 1000 feet of horizontal travel.

Six surface water features are located downstream or downgradient of the Brenntag and Beall source areas: the Coulson irrigation ditch, AJ Gravel pond, Corcoran pond, Lower

Lockwood irrigation ditch, a wetland area, and the Yellowstone River.

The Coulson irrigation ditch originates at a diversion structure on the Yellowstone River south (upriver) from the Lockwood Water and Sewer District treatment plant. It flows by gravity to the northeast through the Auto Auction property and then passes along the north boundary of the Brenntag property. The ditch exits the LSGPS beneath Klenck Road and continues through open fields east of the LSGPS. Groundwater influx or seepage into the Coulson irrigation ditch occurs during periods when there is no flow in the ditch, where the bottom of the ditch intercepts the water table. Comparison of water elevation data in the Coulson irrigation ditch to water elevations in monitoring wells adjacent to the ditch indicate portions of the Coulson irrigation ditch are below the water table.

The AJ Gravel pond and the Corcoran pond are located south of the Yellowstone River at the north end of the LSGPS. The ponds are about 1,500 and 1,800 feet downgradient of the Brenntag source area and are the result of former sand and gravel mining activities. The water elevations in the ponds are a reflection of water table elevations.

The Lower Lockwood irrigation ditch does not interact with the groundwater at the LSGPS and does not effect the site.

A permanent wetland area with small open ponds is located in the west portion of the LSGPS about 4,300 feet downgradient of the Beall property. The wetlands extend from east of Cerise Road northeast toward the Sandy-Lomond Lane area. The wetlands were formed in a former chute channel originating from the Yellowstone River and likely receive groundwater year-round.

The Yellowstone River is the main surface water feature in the LSGPS, and the centerline of the channel marks the western and northern boundaries of the LSGPS. The river is approximately 2,000 feet downgradient of the Brenntag source area and 4,600 feet

downgradient of the Beall source area. The Yellowstone River is expected to intercept the groundwater discharging from the LSGPS.

Current land use within the LSGPS is characterized as residential, commercial, and “light” industrial. Examples of commercial and light industrial businesses in the area include trucking, vehicle repair, truck tank manufacturing, chemical repackaging, machine shops, and auto salvage. At this time, the primary source of domestic use water in the LSGPS is from the public water supply, which obtains its water from the Yellowstone River. However, limited full-use domestic, other domestic (such as irrigation), commercial, and nondomestic use water is known to come from the shallow alluvial aquifer via individual wells.

### NATURE AND EXTENT OF CONTAMINATION

In the Brenntag and Beall source areas, the known limits of source material (soil with contaminant concentrations above proposed remediation goals) are shown in Figure 2. For the purposes of Feasibility Study estimations, the volume of source material has been tentatively estimated at 3,865 cubic yards in the Brenntag source area and 16,437 cubic yards in the Beall source area. These estimates include contaminated soil under structures.

The limits of the identified source material have not been fully defined and additional source material is likely present in both source areas. Lateral and vertical limits of source material will be further delineated during the remedial design.



## PRIMARY BALANCING CRITERIA

### Long-Term Effectiveness and Permanence

Institutional controls are necessary to mitigate long-term residual risk for Alternatives 2 through 4. Institutional controls are considered only moderately reliable. Alternative 2 does not provide for any reduction in risk in any of the contaminated media. Alternative 3 does not provide for a reduction of contaminant levels in surface water or groundwater; however, there will not be residual risk in soil. Alternative 4 does not reduce the residual risk in soil and leaves residual risk in groundwater above levels considered acceptable. Alternative 5 leaves residual risk in source area groundwater and soil above levels considered acceptable. Alternatives 6 through 8 reduce residual risk to achieve RAOs in all environmental media over the long term.

### Reduction in Toxicity, Mobility, or Volume of Contaminants through Treatment

Alternative 2 provides no reduction in toxicity, mobility, or volume of contaminants.

Alternative 3 relies on natural attenuation to reduce the toxicity and volume of contaminants in the groundwater outside of the source areas. Alternatives 4 through 8 reduce the toxicity and volume of contaminants through treatment of contaminated groundwater. Under these alternatives, approximately 136 million gallons of contaminated groundwater is treated. These alternatives permanently destroy or remove the contaminants within the groundwater aquifer.

Alternatives 3, 5, 6, 7, and 8 reduce the toxicity and volume of contaminants found in soil. Under Alternatives 3 and 8, contaminants are removed from approximately 20,302 cubic yards of excavated soil by thermal treatment. Under Alternative 6, approximately 3,865 cubic yards of soil are thermally treated. Contaminants are destroyed in-situ with chemical oxidation under Alternatives 6, 7, and 8. Contaminants are removed from soil with soil vapor extraction under Alternatives 5, 6, and 7. Alternatives 6, 7,

and 8 remediate contaminated soil at and below the water table that Alternative 5 cannot remediate due to the limitations of soil vapor extraction. In addition, the effectiveness of Alternative 5 is diminished due to soil heterogeneity.

Alternatives 6, 7, and 8 reduce the mobility of contaminants in the groundwater with permeable reactive barriers. Alternative 7 further reduces contaminant mobility in groundwater downgradient of the Beall source area through hydraulic containment, provided by a pump and treat system. Alternative 4 provides no reduction in contaminants mobility in either soil or groundwater. Soil removal and thermal treatment under Alternatives 3, 6, and 8 greatly reduces the mobility of contaminants migrating from vadose soil to groundwater.

### Short-Term Effectiveness

All alternatives can be implemented within about one year.

Alternatives 2 through 8 have short-term impacts to workers, the public, and the environment during implementation. Alternatives 2 through 8 implement risk mitigation measures and site monitoring that will have minimal impacts to workers, the public, and the environment. Alternatives 4, 5, 6, 7, and 8 have installed aboveground treatment components that may create minor visual and auditory nuisances. The potential for direct contact with contaminants in groundwater occurs when the groundwater remediation systems are operating. Thermal treatment facilities required under Alternatives 3, 6, and 8 function only temporarily. Excavation activities under Alternative 3, 6, and 8 require disruption and removal of some facilities to be effective. Environmental drilling to install monitoring wells and/or extraction and injection wells occur under Alternatives 4 through 8. Environmental drilling and excavation may produce contaminated soil cuttings and liquids that present some risk to environmental workers at the LSGPS. Groundwater monitoring has minimal impact on environmental workers responsible for periodic sampling. Treated air discharges to the

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES
<b>Overall Protectiveness of Human Health and the Environment</b> determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
<b>Compliance with ARARs</b> evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements applicable to the site.
<b>Long-term Effectiveness and Permanence</b> considers the ability of an alternative to protect human health and the environment over time.
<b>Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment</b> evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
<b>Short-term Effectiveness</b> considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents and the environment during implementation.
<b>Implementability</b> considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
<b>Cost</b> includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent, per EPA Guidance.
<b>State/Support Agency Acceptance</b> considers whether the support agency agrees with the lead agency's analyses and recommendations, as described in the Remedial Investigation, Feasibility Study, and Proposed Plan. For the LSGPS, EPA is the support agency and DEQ is the lead agency.
<b>Community Acceptance</b> considers whether the local community agrees with DEQ's analyses and Preferred Alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment

Because Alternative 1 is not protective of human health and the environment, it is eliminated from consideration under the remaining eight criteria.

Alternatives 2 through 8 provide adequate, but not equal, protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, and/or institutional controls.

Contaminants in soil are treated to achieve RAOs in Alternative 3 (excavation and thermal treatment), Alternative 6 (soil vapor extraction, excavation and thermal treatment, and in-situ chemical oxidation), Alternative 7 (soil vapor extraction and in-situ chemical oxidation), and Alternative 8 (excavation and thermal treatment and in-situ chemical oxidation).

Contaminants in groundwater are treated to achieve RAOs in Alternative 6 (permeable reactive barrier, enhanced bioremediation, and natural attenuation), Alternative 7 (permeable reactive barrier and natural attenuation), and Alternative 8 (permeable reactive barrier, air sparging/soil vapor extraction, enhanced bioremediation, and natural attenuation).

Contaminants in surface water achieve RAOs (through groundwater remediation) in Alternatives 4, 5, 6, 7, and 8.

Compliance with ARARs

There are no federal or state contaminant-specific soil quality standards. All location- and action-specific ARARs are met for Alternatives 2 through 8. Chemical-specific ARARs for groundwater and surface water may not be met in Alternatives 2 through 5. All ARARs are met in Alternatives 6 through 8.

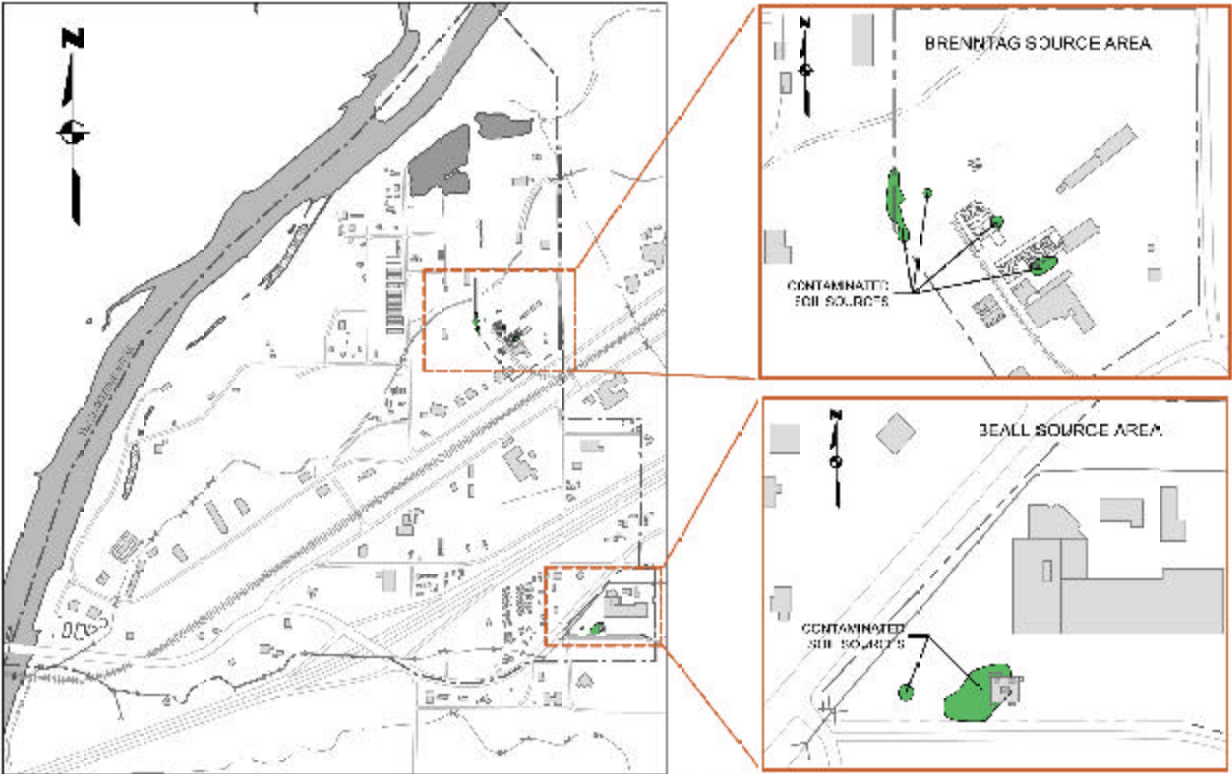


FIGURE 2 - SOIL SOURCE AREAS

Sampling has detected low-level concentrations of chlorinated solvents in groundwater throughout the LSGPS with higher concentrations within and downgradient of source areas (see Figure 3). The extent of contamination has been delineated on the southern and eastern boundaries by sample locations where no contaminants were detected. Groundwater contamination is delineated (bounded) on the western and northern edges by the Yellowstone River; no samples were collected on the west or north side of the Yellowstone River. The highest concentrations of contaminants in groundwater at the LSGPS are found within and downgradient of the Brenntag and Beall source areas. Concentrations above state human health standards and federal maximum contaminant levels (MCLs) are found throughout the site. These contaminants pose a potential threat to human health. The MCL is the maximum permissible level of a contaminant in water,

which is delivered to any user of a public water system.

The chlorinated solvent plume in the alluvial aquifer extends from the Beall and Brenntag source areas toward the Yellowstone River. A portion of the plume discharges into the Coulson irrigation ditch during the non-irrigation season and into the AJ Gravel pond year-round. The bedrock aquifer downgradient from the Beall source area has low contaminant concentration levels of chlorinated solvents. The bedrock aquifer downgradient from the Brenntag source area does not appear to be adversely affected by chlorinated solvents. Groundwater modeling suggests the contaminant plume downgradient of the Beall source area is slowly increasing in size and the plume downgradient of the Brenntag source area is not changing.

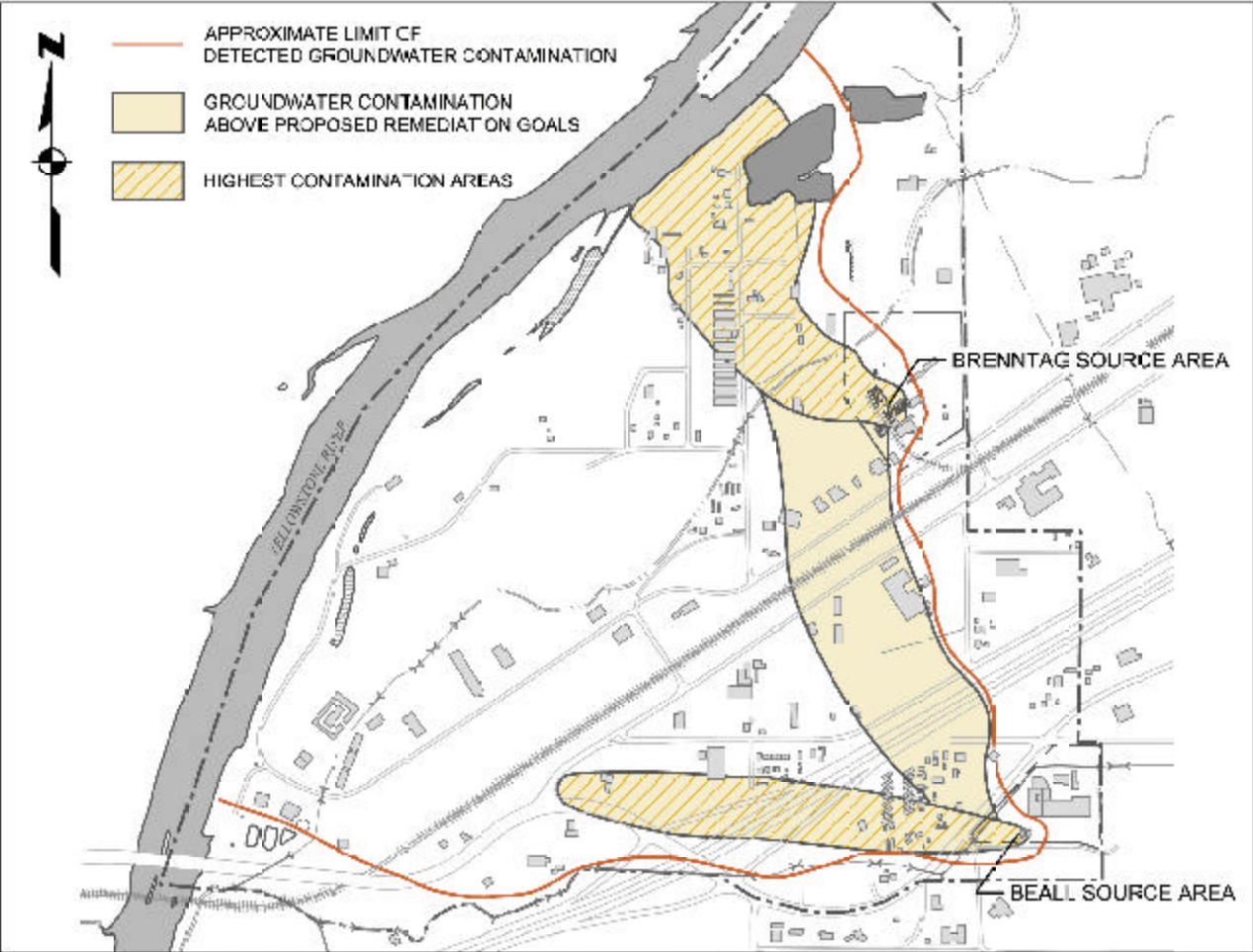


FIGURE 3 - GROUNDWATER CONTAMINATION AREAS

Surface water samples collected from the AJ Gravel pond contained concentrations of contaminants above surface water human health standards. Sampling detected contaminants in the Coulson irrigation ditch at concentrations below state of Montana surface water standards. Data indicate contaminants in the AJ Gravel pond and Coulson irrigation ditch are the result of contaminated groundwater discharge into these surface waters. Contaminated groundwater likely discharges into the irrigation ditch only during non-irrigation periods. Surface water in Coulson irrigation ditch flows off-site to the northeast. No sediment samples contained contamination at concentrations above ecological sediment screening values. Mathematical estimates indicate contaminant concentrations in the Yellowstone River would not be measurable.

EPA’s initial screening of ambient air in residences indicated a concern with vapor contaminant concentrations in living spaces of two residences in January 2000. EPA performed vapor mitigation in these residences, and post-mitigation sampling indicated a reduction of PCE vapors to concentrations below EPA’s screening levels. Results of DEQ’s successive sampling program did not indicate a concern with indoor vapor contaminant concentrations. EPA’s Region 8 Superfund Technical Support Program re-evaluated the indoor air data following the release of EPA’s draft Vapor Intrusion Guidance (November 2002). The evaluation suggests potential concerns with indoor air vapors, as discussed in the Human Health Risk Assessment section of this Proposed Plan. The technical memorandum containing the re-evaluation can be found in the Administrative record.

*Alternative 8 –Containment and treatment of groundwater with Permeable Reactive Barriers at both the Brenntag and Beall source areas, containment and treatment of groundwater with Air Sparging and Soil Vapor Extraction at the Beall source area plume leading edge, treatment of groundwater with Enhanced Bioremediation, Excavation and Thermal Treatment of vadose soil, treatment of saturated zone soil with In-Situ Chemical Oxidation, and Monitored Natural Attenuation of groundwater*

Estimated Capital Cost: \$12,417,577  
Estimated First Year Annual O&M Cost: \$821,313  
Estimated Periodic Cost: \$816,802  
Permeable Reactive Barrier Replacement Cost (Year 15): \$4,082,469  
Estimated Present Worth Cost: \$20,372,500  
Estimated time to construct and implement: One Year  
Estimated time until RAOs are met:  
Brenntag and Beall source area soil – One year  
Groundwater and Surface Water downgradient of Brenntag and Beall source areas – Nine years  
Groundwater in Beall and Brenntag source areas – Long term

The approach to remediation under Alternative 8 includes an aggressive combination of available groundwater and soil treatment options that will achieve RAOs in all media in the shortest timeframe of all the alternatives and not rely upon institutional controls and risk mitigation measures for protection of human health and the environment over the long term. Both the soil vapor extraction system and excavation and thermal treatment of contaminated soil are EPA presumptive remedies for soil contaminated with chlorinated solvents. Approximately 20,302 cubic yards of soil and 136 million gallons of groundwater will be treated. Alternative 8 is expected to meet all federal, state, and local ARARs, including chemical-specific ARARs for groundwater and surface water, over the long term. Groundwater contaminant concentrations within and downgradient of source areas are expected to meet RAOs and remediation goals over the long term. There are no federal or state contaminant-specific soil quality standards.

EVALUATION OF ALTERNATIVES

DEQ and EPA used nine criteria to evaluate the different remediation alternatives individually and against each other in order to select a remedy. This section of the Proposed Plan profiles the relative performance of each alternative against eight of the nine criteria (Community Acceptance will be evaluated after comments are received on the Proposed Plan), noting how it compares to the other alternatives under consideration. The nine evaluation criteria are discussed below. A more detailed evaluation of alternatives may be found in the Final Feasibility Study.



*Alternative 6 – Containment and treatment of groundwater with a Permeable Reactive Barrier at the Brenntag source area, treatment of groundwater with Enhanced Bioremediation, Excavation and Thermal Treatment of vadose soil at the Brenntag source area, treatment of vadose soil with Soil Vapor Extraction at the Beall source area, treatment of saturated zone soil with In-Situ Chemical Oxidation at the Brenntag source area, and Monitored Natural Attenuation of groundwater*

Estimated Capital Cost: \$6,202,814  
Estimated First Year Annual O&M Cost: \$1,012,352  
Estimated Periodic Cost: \$1,219,740  
Permeable Reactive Barrier Replacement Cost (Year 15): \$1,628,764  
Estimated Present Worth Cost: \$14,453,800  
Estimated time to construct and implement: One Year  
Estimated time until RAOs are met:  
Beall source area soil – Five years  
Brenntag source area soil – One year  
Groundwater and Surface Water downgradient of Brenntag and Beall source areas – Nine years  
Groundwater in Beall and Brenntag source areas – Long term

The approach to remediation under Alternative 6 includes a combination of groundwater and soil treatments that will achieve RAOs in all media and do not rely upon institutional controls and risk mitigation measures for protection of human health and the environment over the long term. Both the soil vapor extraction system and excavation and thermal treatment of contaminated soil are EPA presumptive remedies for soil contaminated with chlorinated solvents. Approximately 20,302 cubic yards of soil and 136 million gallons of groundwater will be treated. Alternative 6 is expected to meet all federal, state, and local ARARs, including chemical-specific ARARs for groundwater and surface water, over the long term. Groundwater contaminant concentrations within and downgradient of source areas are expected to meet RAOs and remediation goals over the long term. There are no federal or state contaminant-specific soil quality standards.

*Alternative 7 – Containment and treatment of groundwater with Permeable Reactive Barriers at both the Brenntag and Beall source areas, containment of groundwater with Hydraulic Barrier at the Beall source area plume leading edge, treatment of vadose soil by Soil Vapor Extraction, treatment of saturated zone soil with In-Situ Chemical Oxidation, and Monitored Natural Attenuation of groundwater*

Estimated Capital Cost: \$7,767,554  
Estimated First Year Annual O&M Cost: \$1,090,416  
Estimated Periodic Cost: \$42,011  
Permeable Reactive Barrier Replacement Cost (Year 15): \$4,082,469  
Estimated Present Worth Cost: \$16,576,800  
Estimated time to construct and implement: One Year  
Estimated time until RAOs are met:  
Brenntag and Beall source area soil – Five years  
Groundwater and Surface Water downgradient of Brenntag source area – Ten years  
Groundwater downgradient of Beall source area – 24 years  
Groundwater in Beall and Brenntag source areas – Long term

The approach to remediation under Alternative 7 includes a combination of in-situ groundwater and soil treatments and hydraulic containment that will achieve RAOs in all media and not rely upon institutional controls and risk mitigation measures for protection of human health and the environment over the long term. Soil vapor extraction treatment of contaminated soil is one of EPA’s presumptive remedies for soil contaminated with chlorinated solvents. Approximately 20,302 cubic yards of soil and 136 million gallons of groundwater will be treated. Alternative 7 is expected to meet all federal, state, and local ARARs, including chemical-specific ARARs for groundwater and surface water, over the long term. Groundwater contaminant concentrations within and downgradient of source areas are expected to meet RAOs and remediation goals over the long term. There are no federal or state contaminant-specific soil quality standards.

SCOPE AND ROLE OF THE REMEDIAL ACTIONS

DEQ has identified two source areas with contaminated soil and groundwater and contaminated groundwater plumes emanating from those source areas. In addition, DEQ has identified areas of site-wide groundwater contamination. The overall cleanup strategy for the LSGPS will consist of aggressive source area soil remediation and active source area groundwater remediation with groundwater remediation and monitored natural attenuation for site-wide groundwater. DEQ will ensure the continued protection of public health by monitoring contaminant concentrations in groundwater and providing alternate potable water as necessary. Through the use of treatment technologies, the preferred alternative will permanently reduce the toxicity, mobility, and volume of source materials that constitute the principal threat wastes at the LSGPS.

SUMMARY OF SITE RISKS

DEQ conducted Baseline Human Health and Ecological Risk Assessments under the Remedial Investigation following EPA guidelines.

Based on the results of the risk assessment, with contaminant concentrations above MCLs in groundwater and above proposed groundwater protection goals in soil, both DEQ and EPA believe the Preferred Alternative identified in this Proposed Plan is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

DEQ divided the LSGPS into exposure subareas for the risk evaluations, resulting in discrete human health risk assessments in nine areas (Figure 4): Area A (source and nonsource areas), Area B (source and nonsource areas), Area C, the AJ Gravel pond, the Coulson

irrigation ditch, the wetland area on Cerise Road, and the Yellowstone River. The last three areas did not have contaminants present at concentrations posing a threat to human health or the environment. Therefore, DEQ calculated risks and hazards for the other six remaining areas.

HUMAN HEALTH RISK ASSESSMENT

For the human health risk assessment, DEQ calculated both cancer risks and noncancer hazard indices for an array of current and future residential and industrial exposure scenarios at the LSGPS.

DEQ characterized cancer risks associated with exposure to contaminants classified as carcinogens (e.g., vinyl chloride) as an estimate of the probability (excess risk) that an individual will develop cancer over a 70-year lifetime as a direct result of exposure to potential carcinogens. For example, a cancer risk of  $1 \times 10^{-6}$  indicates that an individual has a 1-in-1 million probability of developing cancer during a lifetime as a result of the assumed exposure conditions.

For known or suspected carcinogens, acceptable additional cancer risk falls within a range between one person in ten thousand ( $1 \times 10^{-4}$ ) and one person in a million ( $1 \times 10^{-6}$ ), known as the risk management range. Risks below  $1 \times 10^{-6}$  are considered to be insignificant. Risks above  $1 \times 10^{-4}$  may indicate the need for further evaluation or remediation.



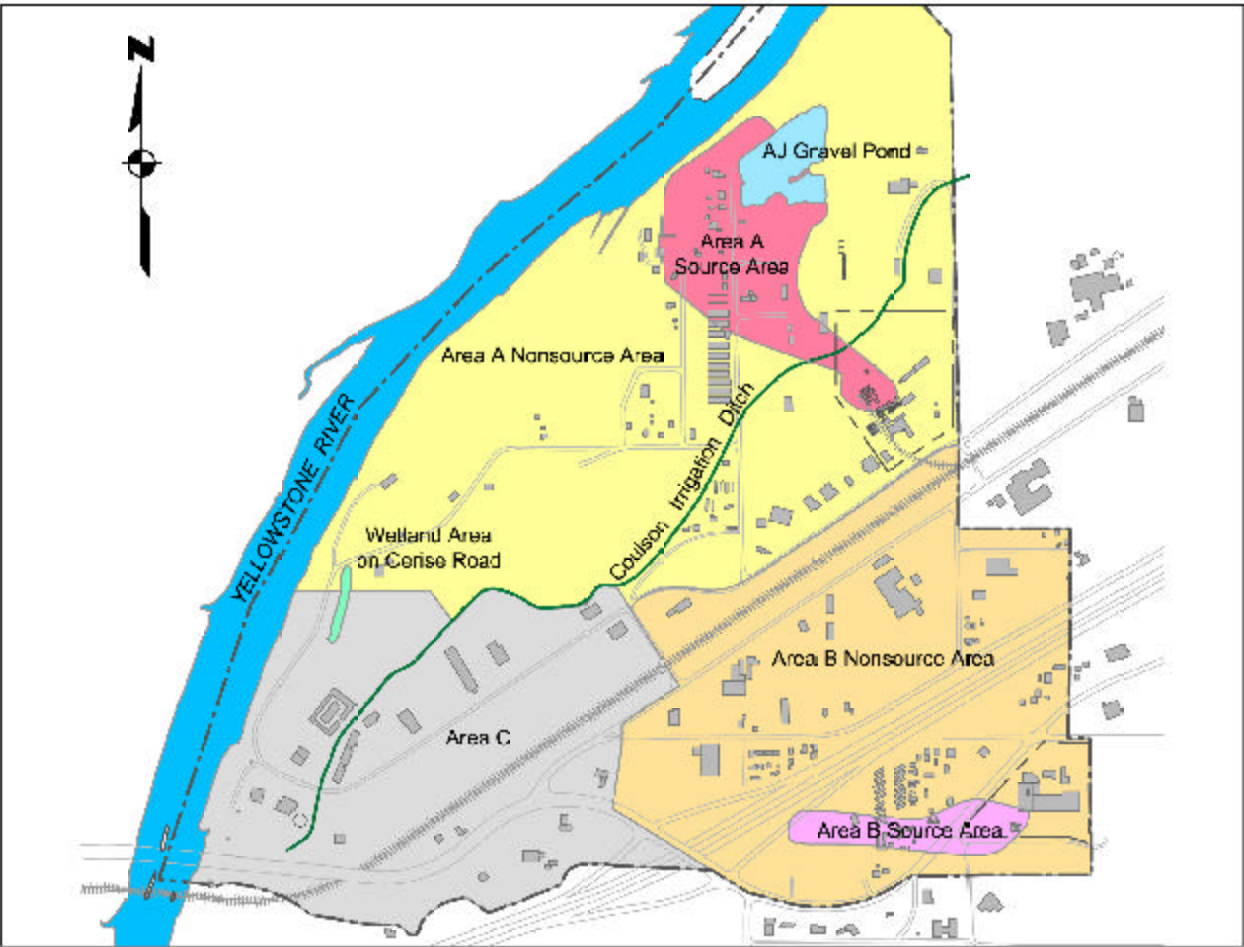


FIGURE 4 - RISK ASSESSMENT EXPOSURE AREAS

The human health risk assessment concluded the following scenarios are within the risk management range or considered to be insignificant risks:

- Resident adults and children in each of the subareas using potable water and breathing indoor air.
- Resident adults who use contaminated well water to wash cars or irrigate their lawn in each of the subareas.
- Resident adolescents who recreate with contaminated well water in kiddie pools or sprinklers in each of the subareas.
- Recreators who fish from or wade/dip their arms in the AJ Gravel pond.
- Utility/construction workers in any of the subareas.
- Industrial workers in Area A nonsource, Area B source, Area B nonsource, and Area C subareas who use the public water supply or are supplied an alternate source of drinking water.
- Resident adults and children in Area A nonsource, Area B nonsource, and Area C subareas who use groundwater as a potable water source for whole-house use and/or drinking water source.
- Industrial workers in Area A nonsource, Area B nonsource, and Area C subareas who use groundwater as a potable water source for interior use and/or drinking water source.

*Alternative 4 –Treatment of groundwater with Enhanced Bioremediation followed by Monitored Natural Attenuation*

Estimated Capital Cost: \$2,495,877  
Estimated First Year Annual O&M Cost: \$780,810  
Estimated Periodic Cost: \$1,219,740  
Estimated Present Worth Cost: \$9,905,600  
Estimated time to construct and implement: One Year  
Estimated time until RAOs are met:  
Brenntag and Beall source area soil – Not in the long term  
Groundwater and Surface Water downgradient of source areas – Nine years  
Groundwater in Beall and Brenntag source areas – Not in the long term

Alternative 4 includes active treatment of approximately 136 million gallons of contaminated groundwater with enhanced bioremediation while relying upon institutional controls and risk mitigation measures for protection of human health and the environment over the long term. Alternative 4 does not provide for source soil remediation. Groundwater contaminant concentrations within source areas are expected to remain above RAOs over the long term or rebound above RAOs due to continued migration of contaminants from the source areas. Continued anaerobic and aerobic treatment of groundwater within the source areas will be required over the long term. Alternative 4 is expected to meet all federal, state, and local ARARs, except chemical-specific ARARs for groundwater. Groundwater contaminant concentrations in source areas are expected to remain above RAOs and remediation goals over the long term. Chemical-specific ARARs for surface water are expected to be met over the long term. There are no federal or state contaminant-specific soil quality standards.

*Alternative 5 –Air Sparging and Soil Vapor Extraction to treat groundwater and soil and Monitored Natural Attenuation of groundwater*

Estimated Capital Cost: \$3,722,344  
Estimated First Year Annual O&M Cost: \$1,256,362  
Estimated Periodic Cost: \$42,011  
Estimated Present Worth Cost: \$13,466,500  
Estimated time to construct and implement: One Year  
Estimated time until RAOs are met:  
Beall source area soil – Five years  
Brenntag source area soil – Not in the long term  
Groundwater and Surface Water downgradient of Brenntag source area – Ten years  
Groundwater downgradient of Beall source area – 24 years  
Groundwater in Beall and Brenntag source areas – Not in the long term

Approximately 20,302 cubic yards of soil and 136 million gallons of groundwater is treated under Alternative 5. The approach to remediation under Alternative 5 includes active in-situ treatment of contaminated groundwater and soil using air sparging and soil vapor extraction. Institutional controls and risk mitigation measures for protection of human health and the environment over the long term are necessary. Remediation of soil contaminated with chlorinated solvents through soil vapor extraction is one of EPA's presumptive remedies. Alternative 5 is expected to meet all federal, state, and local ARARs, except chemical-specific ARARs for groundwater. Groundwater contaminant concentrations in the Brenntag source area are expected to remain above proposed remediation goals and regulatory limits over the long term. Chemical-specific ARARs for surface water are expected to be met over the long term. There are no federal or state contaminant-specific soil quality standards.

**Alternative 2 – Institutional Controls and Monitoring**

Estimated Capital Cost: \$119,625  
 Estimated First Year Annual O&M Cost: \$63,730  
 Estimated Periodic Cost: \$42,011  
 Estimated Present Worth Cost: \$698,200  
 Estimated time to construct and implement: One year  
 Estimated time until RAOs are met: Soil and Groundwater – Not in the long term

Alternative 2 is the least aggressive approach to remediation and will protect human health and the environment through institutional controls (e.g., groundwater use restrictions) and risk mitigation measures (e.g., connection of an individual residence to the public water supply). No active groundwater, surface water or soil containment or treatment will occur. Alternative 2 is expected to meet all federal, state, and local ARARs, except chemical-specific ARARs for groundwater and surface water. Groundwater and surface water contaminant concentrations in portions of the LSGPS are expected to remain above RAOs and remediation goals over the long term. There are no federal or state contaminant-specific soil quality standards.

**Alternative 3 – Excavation and Thermal Treatment of soil and Monitored Natural Attenuation of groundwater**

Estimated Capital Cost: \$3,722,268  
 Estimated First Year Annual O&M Cost: \$396,378  
 Estimated Periodic Cost: \$42,011  
 Estimated Present Worth Cost: \$7,046,700  
 Estimated time to construct and implement: One Year  
 Estimated time until RAOs are met: Brenntag and Beall source area soil – One year  
 All Groundwater and Surface Water – Not in the long term

Approximately 20,302 cubic yards of soil will be excavated at both the Brenntag and Beall source areas and thermally treated. Approximately 136 million gallons of groundwater will be treated through monitored natural attenuation. Excavation and thermal treatment is an EPA presumptive remedy for remediation of chlorinated solvents in soil and will provide an effective permanent remedy for soil. Alternative 3 also relies upon institutional controls and risk mitigation measures for protection of human health and the environment over the long term. Although migration of contaminants from soil to groundwater is greatly reduced or eliminated under this alternative, monitored natural attenuation is not expected to reduce groundwater contaminant levels significantly and groundwater contaminant concentrations will remain above RAOs for the foreseeable future. Alternative 3 is expected to meet all federal, state, and local ARARs, except chemical-specific ARARs for groundwater and surface water. Groundwater and surface water contaminant concentrations in portions of the LSGPS are expected to remain above RAOs and remediation goals over the long term. There are no federal or state contaminant-specific soil quality standards.

The following scenarios and receptors had cancer risks indicating the need for further evaluation or remediation:

- Industrial workers in Area A source and Area B source subareas who use contaminated groundwater for unrestricted workplace use, including drinking and washing.
- Industrial workers in Area A source subarea who spend 4 hours of each workday in contact with Area A source subarea groundwater.
- Resident adults and children in Area A source and Area B source subareas who use contaminated groundwater for whole-house use, including bathing, drinking, and washing.

Important uncertainties in these reasonable maximum exposure conclusions are summarized in the baseline human health risk assessment which can be found in the Remedial Investigation Report.

EPA's Region 8 Superfund Technical Support Program re-evaluated the indoor air data following the release of EPA's draft Vapor Intrusion Guidance. The guidance considers new, more stringent "provisional" toxicity factors for PCE and TCE. The re-evaluation suggests intrusion of PCE and TCE vapors from groundwater into indoor air spaces is occurring in four residences. The PCE concentrations in these residences are above site background levels, but below levels of health concern. The TCE concentrations are above site background levels and may be a health concern, based on the new "provisional" toxicity factor for TCE.

**BASELINE ECOLOGICAL RISK ASSESSMENT**

The baseline ecological risk assessment included a detailed screening of all detected contaminants in each medium sampled at the LSGPS specifically for ecological effects. The most conservative available ecological screening values were employed along with updated toxicity information. The LSGPS ecological risk assessment found all surface water,

sediment, and soil concentrations were below conservative screening values.

Additionally, a conservative food model was employed to evaluate top-level avian carnivores, such as the bald eagle, because of that species' possible home range overlap with the LSGPS. Based on this model, the risk assessment concluded there are no unacceptable risks to bald eagles.

The results of the ecological risk assessment indicate the LSGPS does not pose an unacceptable risk to ecological receptors. Based on these findings, no action is required to address ecological risk at the LSGPS.

**REMEDIAL ACTION OBJECTIVES**

DEQ and EPA have established remedial action objectives (RAOs) for each contaminated medium. RAOs are general descriptions of what DEQ and EPA strive to accomplish in order to protect the public against unacceptable risk. No RAOs were developed for ecological receptors because the LSGPS does not pose an unacceptable risk to ecological receptors. Using the RAOs, DEQ and EPA then identify and screen remedial alternatives that will achieve protection of human health and the environment consistent with reasonably anticipated land use. Remediation goals are acceptable contaminant levels or range of levels for each exposure route or medium, expressed as numeric values. DEQ and EPA developed RAOs and preliminary remediation goals based on the results of human health and ecological risk assessments, federal and state groundwater and surface water standards, and site-specific soil modeling (Appendix D, Final Feasibility Study). There are no federal or state soil quality standards. DEQ and EPA completed site-specific soil modeling to establish remediation goals to protect groundwater from the leaching of contaminants from soil.

The following RAOs are defined for groundwater and surface water at the LSGPS:

- Prevent exposure of humans to groundwater and surface water contaminants in concentrations above regulatory standards
- Reduce contaminant concentrations in the alluvial aquifer and surface water to below regulatory standards.
- Prevent or minimize further migration of the contaminant plume (plume containment).

Proposed remediation goals for groundwater and surface water are presented in Table 1.

The following RAO is defined for soil at the LSGPS:

- Prevent or minimize further migration of contaminants from source materials (soil) to groundwater (source control).

Proposed remediation goals for soil are presented in Table 2.

TABLE 1

GROUNDWATER AND SURFACE WATER PROPOSED REMEDIATION GOALS  
LOCKWOOD SOLVENT GROUNDWATER PLUME SITE

Contaminant of Concern	Proposed Remediation Goal (µg/L)	
	Groundwater <sup>1</sup>	Surface Water <sup>2</sup>
cis-1,2-Dichloroethene	70.0	70.0
Tetrachloroethene	5.0	5.0
Trichloroethene	5.0	5.0
Vinyl chloride	2.0	0.2

Notes:

- 1 EPA Maximum Contaminant Level (40 CFR 141 and 142)
  - 2 Montana Numeric Water Quality Standards, Circular Water Quality Bulletin-7
- µg/L Micrograms per liter (also expressed as parts per billion or ppb)

TABLE 2

SOIL PROPOSED REMEDIATION GOALS  
LOCKWOOD SOLVENT GROUNDWATER PLUME SITE

Contaminant of Concern	Proposed Remediation Goal (mg/kg) <sup>1</sup>	
	Brenntag Source Area	Beall Source Area
cis-1,2-Dichloroethene	6.957	1.380
Tetrachloroethene	0.992	0.198
Trichloroethene	1.178	0.235
Vinyl chloride	0.520	0.034

Notes:

- 1 Final Feasibility Study, Appendix D
- mg/kg Milligram per kilogram (also expressed as parts per million or ppm)

SUMMARY OF REMEDIAL ALTERNATIVES

Summaries of eight remedial alternatives for the LSGPS are presented below. The components and alternatives are described in more detail in the Final Feasibility Study.

Cost estimates include the costs of construction and appropriate long-term costs to operate and maintain the alternative. The present worth cost represents the amount of money that, if invested in the initial year of the remedial action, will provide the funds required to cover all costs associated with the remedial action over its planned life.

Alternatives 1 through 8 include 5-year reviews as required by CERCLA until the site is remediated. These reviews are conducted every 5 years and include document review, site interviews, a site inspection, risk evaluation and a summary report.



Alternative 1 – No Further Action

Estimated Capital Cost: \$0.00  
Estimated Annual O&M Cost: \$0.00  
Estimated Periodic Costs: \$42,011  
Estimated Present Worth Cost: \$90,600  
Estimated time to construct and implement: None  
Estimated time until RAOs are met: Soil and Groundwater – Not in the long term

The No Further Action alternative is required by the NCP. The No Further Action alternative provides a baseline against which other alternatives are compared. Under this alternative, no action is taken to alter current conditions at the LSGPS. No construction, operation, or maintenance of remedial measures is required. Under the No Further Action alternative, groundwater contamination at the LSGPS is assumed to remain in its current condition. Chemical-specific ARARs (legal requirements) will continue to be exceeded in many areas of the LSGPS. No location- or action-specific ARARs exist for the No Further Action alternative because no actions are taken to address the contamination at the LSGPS.

Alternatives 2 through 8 include, at a minimum, the following Common Elements: institutional controls, long-term monitoring, and continued risk mitigation measures.

